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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/526,800

03/07/2005

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IOAP 4.1-1

7409

21036 7590 03/04/2009
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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

03/04/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/526,800	Applicant(s) VIKHAREV ET AL.	
	Examiner RAKESH K. DHINGRA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 1-6,9-13 and 15 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 7,8 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 March 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>03/05,04/08</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Species 1 (the four mirror system of Figs. 1, 2) with claims 7, 8, 14 reading on the elected species, in the reply filed on 12/22/08 is acknowledged. Applicant has however argued that Species 1, 2, 3 are substantially a single species since they are united by a method of producing at least two coherent wave beams. This is not found persuasive because the structures of Species 1 (Figs. 1, 2) and Species 2, 3 (Fig. 3 and Fig. 4) are different, since (as an example) in the case of Figs. 1, 2 (Species 1) the quasi-optical electrodynamic system consists of four mirrors 13 that are displaced in each pair set and enable to direct microwave radiation as four wave beams, whereas in case of Species 2 (Fig. 3) the quasi-optical electrodynamic system consists of two mirrors 13 that enable to direct microwave radiation as two crossing wave beams into the plasma formation region and the substrate acts as a reflecting surface, and thus the species 1, 2, 3 do not follow a common method and are therefore distinct. The requirement is thus made FINAL. Accordingly claims 9-13 have been withdrawn (in addition to method claims 1-6 already withdrawn) being directed non-elected species.

Information Disclosure Statement

The information disclosure statement filed 3/7/2005 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been

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placed in the application file, but the information referred to therein has not been considered. In the instant case no explanation of relevance in English language has been supplied for the Non-patent literature documents 1) Yu P. Raizer, Laser sparks and discharge propagation, Moscow, Nauka, 1974 (Document cited at A3), and 2) Mankelevich Yu A, Rakhimov A.T., Suetin N.V., Sov. J. Plasma Phy, 1995, v 21, No. 10, pp 921-927 (Document cited at A5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mori (US 5,310,426) in view of Wort et al (EP 0 520 832) and Chen (US 5,580,387).

Regarding Claim 7: Mori teaches a reactor system for deposition of diamond films from a gaseous phase in a plasma of a microwave discharge, which system contains a microwave generator B, a transmission line 47 ending with a quasi-optical electrodynamic system 45 (storage circuit), a reaction chamber 1 with a substrate 23 placed in the chamber, and a system D for pump-in and a system E for pump-out of the selected gaseous mixture, the apparatus comprises a quasi-optical electrodynamic system adapted to form a standing microwave (within the microwave cavity 1) in an area selected in a vicinity of the substrate 23, and the transmission line is as an circular waveguide 47 (pipe shaped) [e.g. Figs. 5, 6, 12, 13 and col. 9, lines 15-50 and col. 11, lines 35-68]. Though Mori does not explicitly teach a substrate support, the same would be obviously provided to support the substrate during processing. Further claim limitation “oversized” is not given any additional patentable weight in view of applicant not disclosing any specific size/dimensions for the circular waveguide 14 (e.g. specification at paragraph 0044). ”.

Mori does not the waveguide has corrugations and is supplemented with a mirror system to transfer at least one Gaussian beam to the said quasi-optical electrodynamic system.

Wort et al teaches a deposition apparatus comprising a microwave source 10 supplying microwaves to a reaction chamber 28 through a waveguide 14 that I supplemented with a mirror 18 that enables to transfer the microwave beam to a quasi-optical electrodynamic system 22 (e.g. Fig. 1 and col. 4, lines 10-45).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to supplement the circular waveguide with a mirror system as taught by Wort et al in the apparatus of Mori to enable transfer the incoming microwave beam as a parallel beam towards the quasi-optical electrodynamic system.

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Mori does not explicitly the waveguide has corrugations on its internal surface.

However providing internal corrugations in a waveguide is known in the art to enable generate stable microwave modes.

Chen teaches a plasma apparatus comprising a circular waveguide with ridges (corrugations) 16 on its internal surface, that supplies microwave power to a plasma applicator with a quartz chamber 30, and where the corrugations 16 in the circular waveguide enable to provide a stable mode of microwaves inside the waveguide (e.g. Figs. 1-3 and col. 3, line 25 to col. 4, line 25).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the circular waveguide with internal corrugations as taught by Chen in the apparatus of Mori in view of Wort et al to enable provide a stable mode of microwaves inside the waveguide

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mori (US 5,310,426) in view of Wort et al (EP 0 520 832) and Chen (US 5,580,387) as applied to claim 7 and further in view of Yamamoto et al (US 6,620,290).

Regarding Claim 8: Mori in view of Wort et al and Chen teach all limitations of the claim including the quasi-optical system 45 has four mirrors 57 or 62 situated on different sides relative to a region of plasma formation (within reaction chamber 1) {Mori – Figs. 11-14). Further, Mori teach pair-wise crossing of two microwave beams and the quasi-optical system of mirrors 62 with part of transmission line 61 is installed within the chamber 1 (Fig. 13). Though Mori in view of Wort et al and Chen do not explicitly teach microwave radiation as four beams

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(even though he teaches use of four mirrors 57 or 62) it would be obvious to rearrange the four mirrors of Mori with respect to the incoming microwaves from the circular waveguide 14, so as to direct the microwaves as four beams and obtain a wider coverage area of microwaves for processing a large substrate.

Mori in view of Wort et al and Chen do not teach the transmission line is supplemented with a divider, which divides one wave beam into four beams and is installed at an output of the said oversized circular waveguide.

However use of microwave power divide waveguides are known in the art as per reference cited hereunder.

Yamamoto et al teach a plasma apparatus comprising microwave generator S2, a waveguide 3b and a divider (connected between waveguide 3b and dielectric window 2b) that divides the incoming microwave beam into four parts (e.g. Figs 12 and col. 10, lines 23-45). It would be obvious to provide a divider with the transmission line as taught by Yamamoto et al in the apparatus of Mori in view of Wort et al and Chen to obtain improved plasma uniformity.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a divider with the transmission line as taught by Yamamoto et al in the apparatus of Mori in view of Wort et al and Chen to obtain improved plasma uniformity.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mori (US 5,310,426) in view of Wort et al (EP 0 520 832) and Chen (US 5,580,387) as applied to claim 7 and further in view of Aoyama et al (US 5,651,827) and Hawkins et al (US 5,819,684).

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Regarding Claim 14: Mori in view of Wort et al and Chen teach all limitations of the claim except the system for pumping gas into the reaction chamber is made as a concave metal screen with a feeding tube in a central part, and the screen is situated over the substrate holder at an adjustable distance, and the system for pumping the gas out is made as a set of apertures in the substrate support, which has a volume for the evacuated gas mixture, and in this volume the system for water cooling of the upper part of the substrate support is situated.

Aoyama et al teach a substrate processing apparatus comprising a reaction chamber 20, a support table 3 with an aperture (volume for the evacuated gas) for gas exhaust (through line 9). Aoyama et al further teach that the support table is movable vertically. Aoyama et al also teach that substrate support can also have a cooling system (through cooling channel 13) for cooling the substrate holder, and disposed adjacent the evacuated space in mold holder 11 (e.g. Figs. 6, 12 and col. 9, line 19 to col. 10, line 50). Further, though Aoyama et al do not explicitly teach water as cooling fluid, use of same is known in the art for cooling in the semiconductor processing apparatus.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a the substrate holder with apertures for gas exhaust as taught by Aoyama et al in the apparatus of Mori in view of Wort et al and Chen to enable maintain desired pressure adjacent the substrate holder.

Mori in view of Wort et al, Chen and Aoyama et al do not teach the system for pumping gas into the reaction chamber is made as a concave metal screen with a feeding tube in a central part, and the screen is situated over the substrate holder at an adjustable distance.

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Hawkins et al teach a substrate processing apparatus comprising a stainless steel gas injector 31 with a curved wall 37 and apertures for gas outlet. Hawkins et al further teach that the aperture profile and the injector wall 37 are shaped to obtain a desired velocity profile. It would be obvious to optimize the shape of the pump-in gas system wall to obtain optimized gas velocity profile (e.g. Fig. 2 and col. 5, line 45 to col. 6, line 3 and col. 8, lines 1-40).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide gas pump-in system with a metal plate whose shape is optimized as taught by Hawkins et al in the apparatus of Mori in view of Wort et al, Chen and Aoyama et al to obtain an optimized velocity profile of process gases in the processing chamber.

In this connection the courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/K. M./
Primary Examiner, Art Unit 1792